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ECONOMIC HISTORY

Book by Dr. Heaton

A further proof, if it were needed, of the increasing popularity of economics and public appreciation of a sound, concise introduction to the subject is provided by the fact that since 1921 two editions of "Modern Economic History" by Dr. H. Heaton, M.A., M.Com., D.Litt., have been exhausted.

As a last testimony to his interest in the progress of economics in Australia Dr. Heaton, who will leave Adelaide shortly to take the Macdonald Chair of Economic and Political Science in Queen's University, Canada, has produced a completely revised edition of this work under the auspices of the Workers' Educational Association.

Though based on the same principles as its predecessors—that the best approach to the study of economics is an historical and descriptive survey of modern economic life, with the last 200 years as its field, and its range of treatment world-wide, but dealing chiefly with Great Britain, Germany, North America, and Australia—the third edition differs from them in both contents and in the amount of space allotted to its subjects.

The revision has been exhaustive, and nearly all the chapters have been rewritten. Much new matter, particularly that bearing on agricultural development in new countries, has been introduced, and Australian conditions have been treated in greater detail, so that they now occupy more than one-third of the whole book.

Serving Both Sides

Dr. Heaton indicates various alterations and emendations in the characteristic preface, concluding his thanks to those associated with the production of the book with the statement:—"For all errors of fact and opinions, and all attempts to see two sides of a case, I owe the blame to myself." A capacity for seeing two sides of a case is a pleasing fault, particularly in a work of this nature, in which much of the matter is necessarily controversial, and Dr. Heaton's logical, impartial treatment of his subject is of the utmost value to the student, especially when allied to the clear, concise style which he retains throughout the book. Moreover, he does not disdain a colloquialism if it makes for clearer understanding and greater brevity, and he has a happy faculty for endowing facts and figures with human interest.

The history begins with a necessarily brief survey of industry and commerce in the eighteenth century, with special reference to the factors of modern industrialism, such as capital, then in their infancy.

Balancing this is a comprehensive chapter on systems of agriculture and land tenure and the condition of rural society during the same period, the agricultural revolution in continental Europe, and present conditions in Germany, France and Russia. These countries are studied in detail, the treatment of Russia being an admirable piece of work.

Australian Experience

Australian land settlement is given effective treatment, together with a full account of methods of tenure from the free grants of pioneer days to the agitation for breaking up large holdings. The chapter on "Rural Co-operation and State Aid" is one of particular interest to Australian students of economics, as also is the section dealing with the fluctuations in Australian economic progress, in which the cyclical changes are ascribed to the effect of weather on primary production, movements of general price levels, financial policy, speculative activity, and certain psychological factors.

The much-vexed question of free trade and protection of course finds a place, followed by a pertinent chapter on Australian tariff history and industrial developments. Industrial legislation, with special reference to the work done by Germany in this respect, is given prominence, and trade unionism in both Great Britain and Australia is given exhaustive treatment, as well as the question of wages regulation, with a valuable summarising of its results during the last 20 years.

The co-operative movement is discussed at length, from both industrial and social standpoints, with its attendant subjects of welfare work, copartnership, and profit sharing.

With the addition of a concluding chapter on the Socialist movement (which term is extended to cover the newer or more blatant "isms," Syndicalism, Bolshevism, Guild Socialism, and the rest) it is seen that Dr. Heaton has touched on nearly all the more important problems of modern economics, and has produced a work of the utmost value not only to students but to all interested in communal welfare.

The publishers are the Workers' Educational Association of South Australia, in conjunction with MacMillan & Co., Melbourne, and the printing has been most creditably done by the Adelaide house of Vardon & Sons.

SCIENCE AND AGRICULTURE.

What the Chemist and Biologist Have Done

Tribute to a Pioneer Wheat-breeder.

William Farrer, the pioneer wheat breeder, was described by Dr. Richardson last night as a great Australian, whose monument could be seen in nearly every ripening wheat field in Victoria and New South Wales.

At the Prince of Wales Lecture Theatre, Adelaide University, last night, Professor A. E. V. Richardson (Director of the Waite Agricultural Research Institute), delivered the first of a series of three lectures on "Agriculture," taking as his subject "The Application of Science to Agriculture." After dealing with the importance of agriculture to national welfare, and the part played by agricultural education in promoting this welfare, Dr. Richardson said the striking characteristic of modern agriculture was its progressive character. It was ever seeking to add to the advancement of knowledge of crops and livestock through the medium of experimental enquiry. Ancient agriculture, it would appear, had none of these progressive characteristics. The fine array of Greek and Roman writers had this peculiarity—they never looked forward, but always backward.

Superphosphates.

An interesting case of the far-reaching effect of scientific discoveries on agriculture was the simple discovery by Liebig, the famous German agricultural chemist, that the insoluble tribasic phosphate, as found in bones and natural rock phosphates, could be converted into a water soluble phosphate by treatment with sulphuric acid. Liebig, in his report to the British Association in 1840, suggested that this would be a suitable form in which to apply phosphoric acid to crops. Sir John Lawes, of Rothamsted, was one of the first to profit by this discovery, for he not only tested the efficacy of the dissolved bones in his famous experimental plots, but began the manufacture of superphosphate from rock phosphate in 1842, and thus laid the foundation of the large fortune which he subsequently made and devoted to agricultural research. In Australia, in 1922-23, no less than 463,673 tons of artificial fertilisers were used, nearly all of which was superphosphate; 73 per cent. of the whole area sown in crops was fertilised, and in South Australia 87 per cent. of the total area of all crops was treated with artificial manure. There was 114,155 tons of artificial fertiliser used in South Australia in 1923. To-day, so widespread was the use of superphosphate on Australian soils, and so consistent were the results, that the phenomenal response of the average soil to the fertiliser had become commonplace. The problem to-day was not, however, one in which the advisability of the use of superphosphate was questioned, but rather to ascertain how much to use. The determination of the quantity to sow in each of the climatically different districts of the State with some degree of precision was a matter of considerable importance. Experiments showed that on most soils there was a steady and proportionate increase in the yield as the amount of manure applied was increaser until a point was reached, after which the same ratio was not maintained, until eventually there was no further response to further dressings. It had been found that liberal dressings of phosphate not only enabled a profitable cereal crop to be grown, but the indirect effect of the unused residuum was of great value in stimulating the growth of grass when the cereal crop was removed. On a conservative estimate the increase in yield due to the use of superphosphate was certainly not less than three bushels per acre over the wheat belt. The value of this increase, valuing wheat at 5/ per bushel, was £7,500,000 per annum.

Superphosphate was destined to become even more important to Australia's economic welfare, for there was abundant evidence to show that the pasture lands, especially in regions with a rainfall over 20 in., could be greatly increased in stock-carrying capacity by the use of this fertiliser. The area of land in Australia with a 20 in. rainfall was at least fifty times greater than that sown annually to wheat.

The Babcock Test.

In 1890 Dr. Babcock, of the School of Agriculture, Wisconsin University, discovered a simple method of determining the butter-fat content of milk. The principle of the method was that the casein of the milk was dissolved by concentrated sulphuric acid, and that the fat might be readily separated from the milk by centrifugal force. The greatest service of the butter-fat test, however, had been to provide a means of systematically improving the dairy herds of a country. The simple and rapid method of determining the butter-fat percentage of milk provided the dairyman with a means of detecting the unprofitable animals in his herd, and enabled him to build up a herd of efficient butter-fat

Sugar Beet Industry.

Another interesting application of the value of scientific work in assisting agriculture was the improvement of the sugar content of the beet. In 1760 the German chemist, Marggraff, showed that the maximum percentage of sugar obtainable from white varieties of beet was 6.2 per cent., and from red varieties 4.5 per cent. The sugar-beet industry was established by Napoleon as a movement hostile to England. He closed European ports to British trade, and thereby cut off supplies of sugar. After Napoleon's overthrow, the young industry nearly died out, but under the stimulus of bounties it made rapid strides, and to-day nearly two-thirds of the world's sugar was grown by white labor in the temperate zone from sugar-beet, and the remainder was produced from the sugar-cane in the tropics. The modern beet-sugar factory produced 10,000 tons per annum, that was nearly one thousand times as much as the factories of Napoleon's time.

Pasteur's Work.

The work of Louis Pasteur afforded a very striking illustration of the application of the exact methods of chemical and physical research to the phenomena of disease, and the demonstration of a controllable cause for diseases in plants, animals, and human beings. His first piece of research gave him the key to his future work. He set himself the tasks of determining why two compounds, the two tartaric acids deposited from wine lees, though similar in chemical composition, were absolutely different in their properties. Pasteur showed that in all cases of fermentation, where alcohol was produced from malt or grape juice, where vinegar was produced from wine, and where milk turned sour, in all these cases the cause was due to the presence of micro-organisms. Exclude every trace of these organisms, and no change took place. The materials kept unchanged for years. But why did beer, milk, or wine become sour on exposure to air? Pasteur showed that when organisms from the air were excluded, no change took place. In the interior of the grape no germs existed. But when the grape was crushed and exposed to ordinary atmospheric agencies, fermentative and putrefactive changes ran their course. The application of these facts to surgical operations in the able hands of Lister revolutionised surgical practice. Pasteur's discoveries in fermentation inaugurated a new era in the wine-making and dairying industries.

After a study of the diseases of wines, which had a most important practical bearing, he commenced to investigate an epidemic and fatal disease in silkworms in Southern France—a disease which had almost ruined the French silk industry. He succeeded in determining the cause of the disease, and in suggesting methods of preventing its recurrence. His work resuscitated the silkworm industry of France. It was the first of his victories in the application of the experimental methods of the trained chemist to the problems of biology. Pasteur was impressed with the analogies between fermentation and the infectious diseases. An extraordinary opportunity offered in the study of a widespread epidemic disease known as anthrax, which in many parts of France had killed 25 to 30 per cent. of the cattle and sheep. Devaine in 1863 had suggested that the rod-shaped bacteria present in the blood of animals which had died from the disease was the cause of anthrax. Koch, in 1876, showed how to isolate the organism and grow it in pure culture outside the body. Pasteur confirmed these results, and made an even more important discovery, namely, that by growing successive and continued artificial cultures under different conditions, the virus or poison of the organism became weakened or attenuated, and that if this weakened virus or poison was injected into the animal, only a slight attack of the disease occurred, and the animal was rendered immune from further attacks. The virus became a vaccine. This discovery produced a tremendous sensation in the agricultural and medical worlds. Many millions of sheep and cattle had since been treated for anthrax all over the world, and the rate of mortality had been reduced to less than 1 per cent.

The Organisms of the Soil.

The discovery and isolation of the various forms of bacteria of the soils, Dr. Richardson said, formed a fascinating contribution to agricultural science, the significance of which had probably not yet been fully appreciated. Pasteur laid the real foundations of modern microbiology by his classical researches on fermentation. He himself expressed the opinion that nitrification—the curious change of ammonia to nitrates known to take place in the soil—was a bacterial process, Schloesing and Muntz, in 1877, first showed that nitrification was due to micro-organisms. In 1887, Hellriegel and Wilfarth, after much painstaking research, first demonstrated to the world that leguminous plants—the members of the pea family—were able to obtain the nitrogen they needed for growth from the inexhaustible supplies of this element in the atmosphere through the activity of bacteria which lived symbiotically on their roots. Thus was solved a problem which had puzzled agriculturists from the earliest times—the renovating effect of leguminous plants on soil fertility.

Plant Breeding.

The work of the plant breeder had been of incalculable value to the agriculturist in providing him with varieties of farm crops that were more prolific, of better quality, and more resistant to the attack of fungoid diseases. Very valuable help had been placed in the hands of the plant breeder by the scientific work of Gregor Mendel, a monk of the Monastery of Brunn, in Austrian Silesia. Mendel experimented with the hybridisation of peas in the monastery garden, and discovered what was now known as Mendel's law of heredity. That law was now regarded as the greatest of all biological discoveries, and a knowledge of the law was of invaluable aid to the plant breeder. The great value of Mendel's law to the plant-breeder was that it enabled him to forecast what would happen when two dissimilar plants of the same species were hybridised together.

The Work of William Farrer.

The work of William Farrer, Australia's pioneer wheat-breeder, was a remarkable example of what one man could do to stimulate wheat production by the creation of improved varieties. Farrer was a graduate of Cambridge, who settled at Lambrigg, near Canberra, and established a private wheat-breeding station. He devoted himself to the production of new varieties of wheat by selection and by hybridisation. He produced in 1901 his famous Federation wheat, a variety which was very popular in New South Wales, Victoria, and in portions of South Australia, on account of its high yielding capacity. In many parts of Victoria, particularly in the Wimmera, probably the premier wheat-producing district of the Commonwealth, 90 per cent. of the wheat grown was Federation. Its introduction in Victoria had meant at least £500,000 per annum to the Victorian wheat farmers for the past 15 years. So popular had this variety become that Farrer might be said to have changed the color of the harvest-fields of Victoria from golden yellow to dull bronze—the color of his own Federation wheat. Thirty-three new varieties of wheat were produced by Farrer in his 20 years of work. Fifteen of these varieties were widely cultivated in New South Wales and Victoria. He not only produced prolific varieties, but varieties equal in milling quality with the best in the world, and varieties, too, which were immune to rust. Farrer worked on strict Mendelian lines. He never obtained, nor did he ever seek, the slightest monetary advantage from his labors. The single object which actuated him durnig the 20 years he devoted himself to his self-imposed task was the improvement of wheat farming. It was true that his monument was to be seen in nearly every ripening wheatfield in Victoria and New South Wales, but it would be a thousand pities if they allowed the memory of this great Australian to perish for want of proper recognition.

Phylloxera.

In 1863 there were rumors of a mysterious disease on the vines in the Bordeaux district of France. It proved to be the terrible scourge of the vine, the phylloxera. The disease spread rapidly through France, and in 20 years no less than 2,500,000 acres of vines were absolutely destroyed. The total damage done by this pest amounted to £400,000,000—twice the amount of the war indemnity paid by France in the Franco-Prussian war. From France it spread through Europe, Africa, and finally to California and Australia. It broke out in Geelong in 1877, Bendigo and Rutherglen in 1898, and in all 30,000 acres of vines in Victoria were destroyed. This would give some idea of the enormous damage caused by phylloxera. The phylloxera was an aphid native to the country to the east of hto Rocky Mountains. It lived on the leaves of the American species of vine causnig small galls on the leaves, but had little or no effect on the roots of the American vines. The French Government sent a scientific commission to America to study the pest in its native habitat. After prolonged investigation they demonstrated—That while the phylloxera caused galls on the leaves of the American vines they did not in any way affect the roots of these vines. The phylloxera readily attacked roots of the European vines, and soon destroyed them, though the leaves of European vines were immune from attack. Hence, if the European vines, the fruit of which was so valuable for table purposes and for wine-making, were grafted on the roots of American vines, the resultant plant would be quite immune from attack. A good deal of work still required to be done to decide which varieties of American vines would act as the best stocks in the grafting process. After many years of patient systematic experimental work, two species—Riparia and Rupestris—were selected as the best stocks. Riparia was ultimately discarded because, though resistant, it was not lasting.

With the aid of these phylloxera resistant stocks, the processes of reconstituting the